

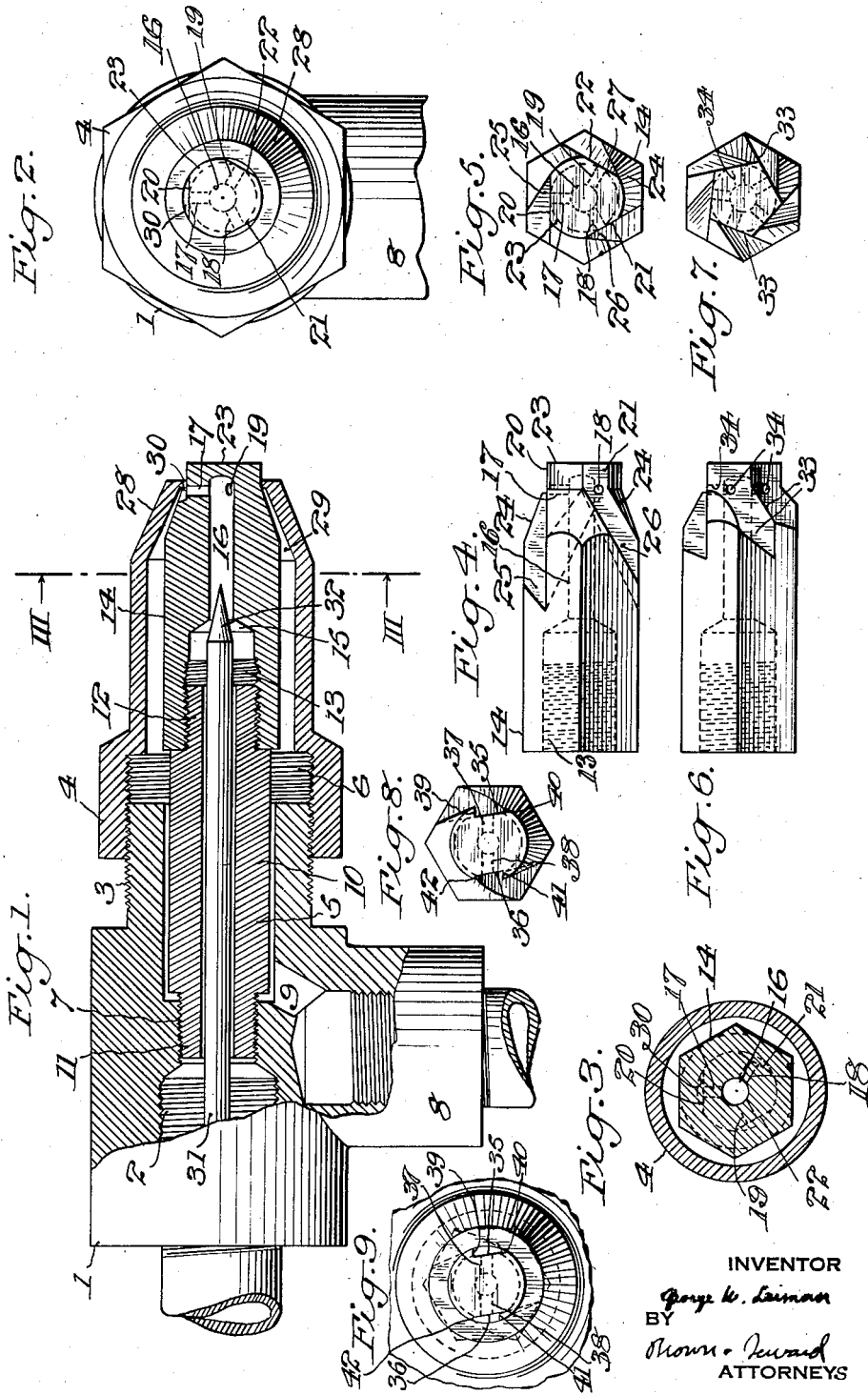
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ATOMIZING NOZZLE

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ATOMIZING NOZZLE

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This invention relates to an atomizing nozzle and has for an object to provide such a device which, while simple in construction, is very effective in producing a mixture of a liquid and a gas that is extremely light and cloudy and free from substantial particles of unatomized liquid.

Another object consists in providing such a device in which the output volume may quickly and easily be varied by substitution of slightly different forms of one element of the atomizing combination.

Another object consists in providing such a device that causes an acute turbulence of the mixture in a very restricted space at the point of first intermingling of the liquid and the gas.

Another object consists in providing such a device which is particularly adapted to the thorough atomization or vaporization of the hydrocarbon oils commonly used in agricultural spraying for insecticide purposes.

A further object consists in providing certain improvements in the form, construction, and arrangement of the parts whereby the above named and other objects may effectively be attained.

A practical embodiment of the invention is represented in the accompanying drawing, in which

Fig. 1 represents a side elevation of my invention partly broken away and partly in section;

Fig. 2 represents a front elevation of the same, the gas supply pipe being omitted;

Fig. 3 represents a transverse vertical section taken in the plane of the line III—III of Fig. 1, looking in the direction of the arrows;

Fig. 4 represents a side elevation of one form of liquid feeding tip;

Fig. 5 represents an end elevation of the same;

Fig. 6 represents a side elevation of another form of tip;

Fig. 7 represents an end elevation of the same;

Fig. 8 represents a front elevation of another modified form of tip; and

Fig. 9 represents a detail front elevation of the same operatively located within the nozzle proper.

As this invention is suitable for many atomizing purposes and is of such general adaptability as to be effectively used with almost any well known or approved form of apparatus for supplying a liquid, such as a hydrocarbon oil, and a gas, such as air or steam, from suitable sources, it is not deemed necessary either to illustrate or describe any parts other than the atomizing ele-

ments proper and parts immediately associated therewith.

Referring to the embodiment of the invention shown in the drawing, the body which supports the nozzle is denoted by 1, and is provided with an interiorly threaded bore 2 extending inwardly from its lower end, whereby the body may be attached to a complementarily threaded portion of suitable apparatus for supplying a liquid, such as a hydrocarbon oil, under suitable pressure.

The upper end of the body 1 is reduced in diameter and exteriorly threaded, as indicated at 3, for reception of the nozzle proper which is denoted generally by 4. This reduced portion 3 is bored so as to provide a cylindrical chamber 5 of the same diameter as the cylindrical bore 6 within the nozzle 4, and the threaded engagement of the portion 3 with the nozzle 4 permits a certain amount of relative longitudinal adjustability of these elements.

The interior of the body 1 between the threaded bore 2 and chamber 5 is formed with a longitudinally disposed interiorly threaded passage 7 of smaller diameter than bore 2 or chamber 5, which passage serves to connect said bore and chamber.

An interiorly threaded hollow nipple 8 is formed integral with and projects laterally from the body 1, which nipple is connected with chamber 5 by means of a port 9 in the adjacent wall of the body 1. This nipple is fitted for threaded connection with appropriate apparatus for supplying a gas, such as air or steam, under pressure.

A tube 10, which has its exterior of pentagonal shape in cross section, has two reduced threaded extremities 11, 12. The extremity 11 is adapted to be screwed into passage 7 and the extremity 12 is fitted for threaded engagement with an interiorly threaded bore 13 formed in the inner portion of a liquid feeding tip 14 which, like tube 10, has its exterior of pentagonal form in cross section. This pentagonal shape of tube 10 and tip 14 provides longitudinal spaces between the tube and tip on the one hand and the cylindrical chamber 5 and cylindrical bore 6 on the other hand.

The bore 13 in tip 14 is tapered at its outer end, as indicated at 15, and communicates with a channel 16 which is much smaller in diameter and runs nearly to the outer extremity of tip 14. The outer end of channel 16 is in communication with three radially disposed minute passages 17, 18, 19 which extend from the said channel to

three flat faces 20, 21, 22 that are formed on the outside of the reduced extremity 23 of tip 14.

The exterior of the said tip adjacent its reduced extremity 23 is tapered, as indicated at 24, and three diagonally disposed V-shaped grooves 25, 26, 27 are formed in the outer surface of the tip 14, which grooves pass through said tapered portion 24 and extend backwardly along the tip for about one third of its length from the reduced extremity 23. One wall of each of said grooves coincides with the flat faces 20, 21, 22 so as to form an inward extension of said faces, and the other wall of each of said grooves terminates outwardly at the junction of the reduced extremity 23 and the tapered portion 24 in substantially the same horizontal plane of the tip 14 as the minute passages 17, 18, 19.

The nozzle proper 4 has its outer end tapered, as indicated at 23, and provided with an inner tapered chamber 29 which communicates with its cylindrical bore 6 and with a mouth 30 formed in the end of nozzle 4. The said tapered chamber 29 and mouth 30 are intended to cooperate with the tapered portion 24 and reduced extremity 23 of tip 14, as well as with the grooves 25, 26, 27 formed in the tip 14; and, when the parts are in operative assembly, the longitudinal relationship of nozzle 4 and tip 14 should be such that the minute radial passages 17, 18, 19 in the reduced extremity 23 of the tip 14 lie in the tapered chamber 29 of the nozzle 4 just within the mouth 30. This relationship may be attained and slightly varied by reason of the screw threaded connection of nozzle 4 with reduced portion 3 of body 1 and/or by the threaded connection between tip 14 and tube 10.

A needle valve 31, which may be mounted in any well known or approved manner lies within body 1, tube 10 and tip 14 with its tapered extremity 32 fitted for valve cooperation with the tapered bore 15 and channel 16 of tip 14. This needle valve 31 may be adjusted, as is customary and well known in the art, so as to regulate the amount of liquid permitted to enter the channel 16 for discharge through the minute radial passages 17, 18, 19.

In operation, a liquid, such as a hydrocarbon oil, is supplied under suitable pressure to the bore 2 in the body 1 and thence through tube 10 and tip 14. Simultaneously a gas, such as air or steam, is supplied under suitable pressure to nipple 3, through port 9 into cylindrical chamber 5 around tube 10 into bore 6 of nozzle 4 around tip 14 through grooves 25, 26, 27, past minute radial passages 17, 18, 19 along faces 20, 21, 22 of the reduced tip extremity 23 and thence outwardly through nozzle mouth 30.

As the gas is under substantial pressure and hence is rushing through its course just described, it will cooperate with the pressure behind the liquid to pick up the latter from the minute passages 17, 18, 19, atomize the liquid, and eject the same in a vapor-like jet or cloud from the mouth 30 of the nozzle 4. The shape and arrangement of the angularly disposed V-shaped grooves 25, 26, 27, in cooperation with the encircling walls of the tapered chamber 29, and together with the flat faces 20, 21, 22 that leave small crescent shaped openings between the reduced extremity 23 of the tip 14 and the wall of the mouth 30, combine to establish a restriction of a peculiarly advantageous nature and to generate a turbulence of extraordinarily high power so as to bring about such a thorough atomization or vaporization of the combined liquid and gas

as to eliminate almost entirely any substantial particles of liquid, and to cause the emission or ejection of an extremely light and homogeneous jet or cloud.

Atomization of the character just described is of prime importance in various connections; notably in connection with agricultural spraying in which it is common to use a hydrocarbon oil carrying an insecticide. In such a case, if thorough vaporization does not take place, small particles or globules of the oil will be apt to remain upon the vegetation to its injury. Therefore, while this atomizing nozzle is, as previously indicated, of general utility, I have found it to be especially efficient in connection with agricultural spraying.

In the form of the invention above described and shown in Figs. 1 to 5 of the drawing, the tip 14 is provided with three faces and with three minute radial passages debauching at said faces. However, it should be stated that the number of faces and passages may be varied and, in Figs. 6 and 7, I have shown a modified form in which there are five similar faces, one of which is denoted by 33, and five similar minute passages, one of which is marked 34. The increase in faces and passages leads to an increased volume of output, and I have found this modified form shown in Figs. 6 and 7 to be very satisfactory when a large jet or cloud of the vaporized mixture is desired.

In the modified form represented in Figs. 8 and 9, there are only two faces on the tip indicated by 35, 36 and two minute passages 37, 38 leading thereto. The faces 35, 36 differ somewhat from the faces shown in the other forms of the invention in that the walls of the angularly disposed V-shaped grooves continue to the extreme end of the tip so as to provide walls or shoulders 39, 40 on each side of face 35, and 41, 42 on each side of face 36; the walls 39 and 41 being somewhat higher than the walls 40 and 42. I have found that this particular construction causes the emission of two distinct jets or fan-like sprays in quite definite form and thoroughly atomized condition, which enables the operator to spray two plants, or the like, simultaneously by holding the nozzle at a suitable distance away from the plants and substantially on a line midway therebetween. The shape of these faces and walls may be varied by forming the walls of substantially the same height or by eliminating entirely one of the walls, but experience has shown that the form illustrated is particularly satisfactory.

In addition to the variations or modifications in the form of the faces on the extremity of the liquid feeding tip, I may also vary the cross sectional form of the exterior of the tip and the tube 10 to which it is secured. Thus, while these parts are shown as pentagonal in cross section, they may be provided with a lesser or greater number of sides.

It is of importance in using this vaporizing nozzle that the minute passages in the faces of the tip be not located beyond, i. e. outside of, the mouth of the nozzle proper, so that the effective agitation and turbulence hereinabove explained may be insured; but there is a range of adjustability as to the longitudinal relationship of the minute passages in the tip and mouth of the nozzle with varying effects, to which the user may resort as occasion dictates.

The parts of the device may be composed of any suitable material which is resistant to the in-

gredients of the mixture, and I have found brass to be generally satisfactory.

It will be understood that various changes may be resorted to in the form, construction, arrangement and material of the several parts, without departing from the spirit and scope of my invention, and hence I do not intend to be limited to the details herein shown and described except as they may be included in the claims.

What I claim is:

1. An atomizing device comprising, a nozzle having a mouth, and a tip located within the nozzle with space therebetween, said tip having a longitudinal channel formed therein, flat faces on its outer extremity, radial passages extending from the channel to said faces, and angularly disposed grooves formed in the tip extending from an inner portion of the space between the tip and nozzle in an outward direction to the said faces and radial passages, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

2. An atomizing device comprising, a nozzle having a tapered end and a mouth formed therein, and a tip located within the nozzle with space therebetween, said tip being provided with a tapered portion for cooperation with the tapered end of the nozzle and a projection extending beyond said tapered portion, the said tip having a longitudinal channel formed therein, flat faces on its said projection, radial passages extending from the channel to approximately the junction of said tapered portion and said projection on the tip, and angularly disposed grooves extending from the space between the tip and nozzle through said tapered portion to said faces and radial passages, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

3. An atomizing device comprising, a nozzle having a tapered end and a mouth formed therein, and a tip located within the nozzle with space therebetween, said tip being provided with a tapered portion for cooperating with the tapered end of the nozzle and a projecting extension beyond said tapered portion, the said tip having a longitudinal channel formed therein, flat faces on its said projection, radial passages extending from the channel to approximately the junction of said tapered portion and said projection on the tip, and angularly disposed grooves extending from the space between the tip and nozzle through said tapered portion to said faces and radial passages, one wall of said grooves constituting an extension of the adjacent face on the projection of the tip and the other wall terminating at the junction of said face and the tapered portion on the tip, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

4. An atomizing device comprising, a nozzle having a mouth, and a tip located within the nozzle with space therebetween, said tip having

a longitudinal channel formed therein, three or more flat faces on its outer extremity, radial passages extending from the channel to said faces, and angularly disposed grooves formed in the tip extending from an inner portion of the space between the tip and nozzle in an outward direction to the said faces and radial passages, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

5. An atomizing device comprising, a nozzle having a tapered end and a mouth formed therein, and a tip located within the nozzle with space therebetween, said tip being provided with a tapered portion for cooperation with the tapered end of the nozzle and a projection extending beyond said tapered portion, the said tip having a longitudinal channel formed therein, three or more flat faces on its said projection, radial passages extending from the channel to approximately the junction of said tapered portion and said projection on the tip, and angularly disposed grooves extending from the space between the tip and nozzle through said tapered portion to said faces and radial passages, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

6. An atomizing device comprising, a nozzle having a tapered end and a mouth formed therein, and a tip located within the nozzle with space therebetween, said tip being provided with a tapered portion for cooperation with the tapered end of the nozzle and a projection extending beyond said tapered portion, the said tip having a longitudinal channel formed therein, three or more flat faces on its said projection, radial passages extending from the channel to approximately the junction of said tapered portion and said projection on the tip, and angularly disposed grooves extending from the space between the tip and nozzle through said tapered portion to said faces and radial passages, one wall of said grooves constituting an extension of the adjacent face on the projection of the tip and the other wall terminating at the junction of said face and the tapered portion on the tip, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

7. An atomizing device comprising, a nozzle having a tapered end and a mouth formed therein, and a tip having at least five sides located within the nozzle with space therebetween, said tip being provided with a tapered portion for cooperation with the tapered end of the nozzle and a projection extending beyond said tapered portion, the said tip having a longitudinal channel formed therein, three or more flat faces on its said projection, radial passages extending from the channel to approximately the junction of said tapered portion and said projection on the tip, and angularly disposed grooves extending from the space between the tip and nozzle through said tapered portion to said faces and radial passages, said passages lying in a plane

that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

8. An atomizing device comprising, a nozzle having a tapered end and a mouth formed therein, and a tip having at least five sides located within the nozzle with space therebetween, said tip being provided with a tapered portion for cooperation with the tapered end of the nozzle and a projection extending beyond said tapered portion, the said tip having a longitudinal channel formed therein, three or more flat faces on its said projection, radial passages extending from the channel to approximately the junction of said tapered portion and said projection on the tip, and angularly disposed grooves extending from the space between the tip and nozzle through said tapered portion to said faces and radial passages, one wall of said grooves constituting an extension of the adjacent face on the projection of the tip and the other wall terminating at the junction of said face and the tapered portion on the tip, said passages lying in a plane that is not outwardly of the nozzle mouth, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

9. An atomizing device comprising, a nozzle having a mouth, and a tip located within the nozzle with space therebetween, said tip having a longitudinal channel formed therein, flat faces on its outer extremity, radial passages extending from the channel to said faces, angularly disposed grooves formed in the tip extending from an inner portion of the space between the tip and nozzle in an outward direction to said faces

and radial passages, a wall of said grooves continuing to a point beyond said passages, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

10. An atomizing device comprising, a nozzle having a mouth, and a tip located within the nozzle with space therebetween, said tip having a longitudinal channel formed therein, flat faces on its outer extremity, radial passages extending from the channel to said faces, angularly disposed grooves formed in the tip extending from an inner portion of the space between the tip and nozzle in an outward direction to said faces and radial passages, the walls of said grooves continuing to a point beyond said passages, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

11. An atomizing device comprising, a nozzle having a mouth, and a tip located within the nozzle with space therebetween, said tip having a longitudinal channel formed therein, flat faces on its outer extremity, radial passages extending from the channel to said faces, angularly disposed grooves formed in the tip extending from an inner portion of the space between the tip and nozzle in an outward direction to said faces and radial passages, the walls of said grooves continuing to a point beyond said passages, one wall of each groove being higher than the other wall of said groove, means for supplying a liquid to said channel, and means for supplying a gas under pressure to said space between the nozzle and the tip and through said grooves to said faces and passages.

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